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ABSTRACT

This document evaluates the Parks as Resources for Knowledge in Science (PARKS) project which supports environmental education in 36 National Parks across the United States and provides curriculum-based learning opportunities that integrate National Science Education Standards for teachers and students. Contents include: (1) "Executive Summary--PARKS at a Glance"; (2) "Introduction--What Was the PARKS Project?" which includes background information and the PARKS National Evaluation; (3) "Program Descriptives--Who Was Involved in the PARKS Project?"; (4) "Program Descriptives--What PARKS Projects Look Like"; (5) "Inputs--What Went into the PARKS Project?" which includes collaboration information and the incorporation of the National Science Education Standards; (6) "Outcomes--How Were the People Involved Affected by the Project?" which discusses participant students, participating teachers and schools, teams, and National Park Service programming; and (7) "Conclusions and Recommendations--Final Thoughts" which covers collaboration, the National Science Education Standards, stewardship, and transferability. (YDS)

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Parks As Resources for Knowledge in Science (PARKS)

National Program Evaluation Final Report

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***Parks As Resources in Knowledge and Science* was a collaborative effort with The Ohio State University and the National Science Teachers Association.**

Parks As Resources for Knowledge in Science

National Program Evaluation Final Report

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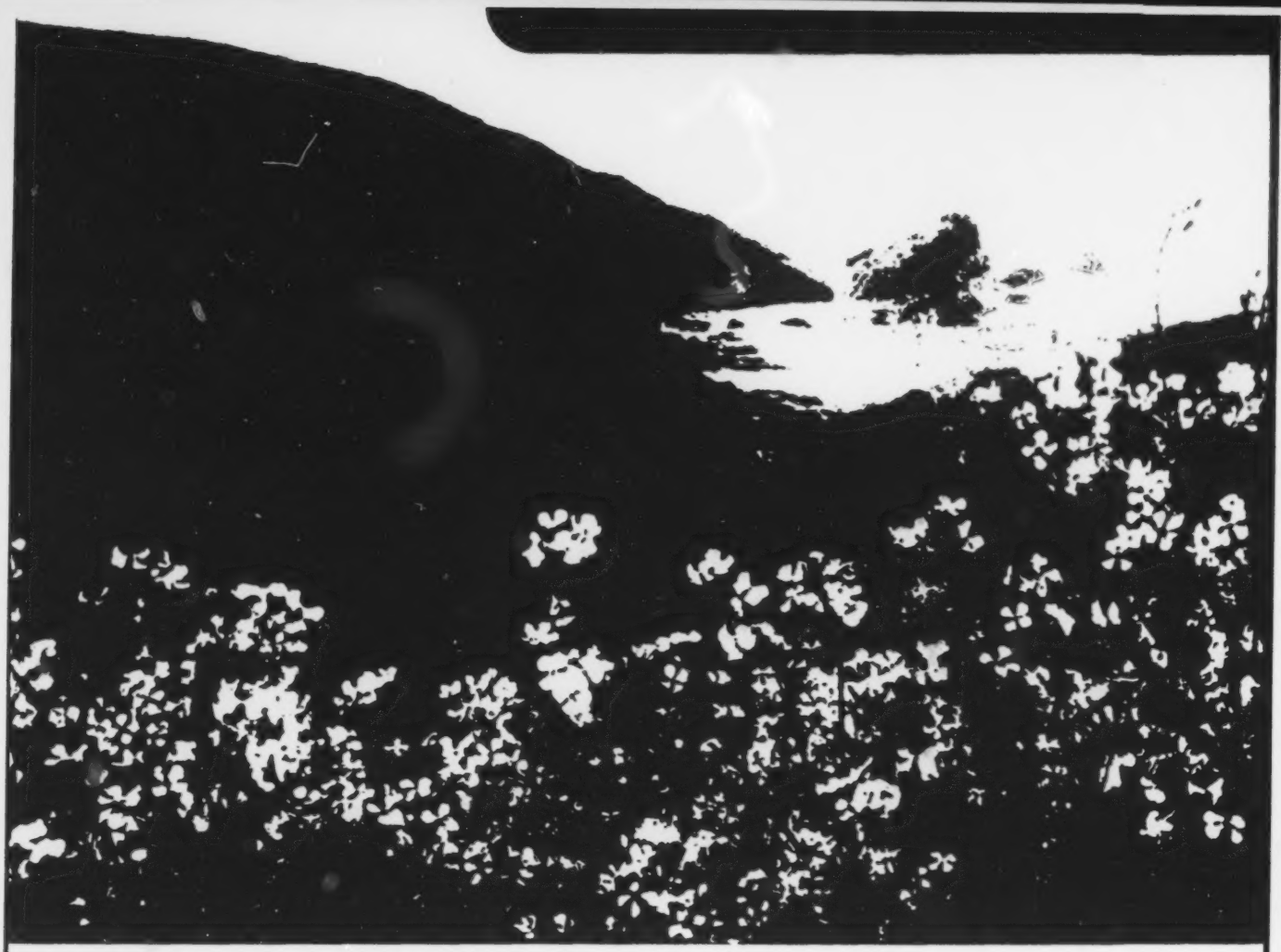


Executive Summary

PARKS at a glance

Parks As Resources for Knowledge in Science (PARKS) involved 36 National Parks in partnerships with schools in their communities. The park-school teams worked over the three-year grant period to integrate the National Science Education Standards (NSES) into park-based education. The *PARKS* approach to science education was founded in the belief that through local collaboration between formal and nonformal educators, both science learning and the stewardship of the National Parks could be improved.

During year one, teams established their collaborative relationships, created workplans, and received training on the NSES and program evaluation. Years two and three saw the implementation of the *PARKS* programs at the 36 sites. Programs varied tremendously in content as well as intended audience. Approximately 90,000 students in grades K-12 participated in *PARKS* programming. Program formats included visits to the NPS

Point Reyes National Seashore

sites, in-school activities, overnight trips, and web-based learning – many programs combined more than one of these activities.

A stakeholder-based cluster evaluation of the *PARKS* program was undertaken by the Ohio State University Environmental Program Evaluation Working Group in order to look at the success of the project across the 36 different programs. The evaluation employed a multi-method approach including program observations, student and teacher questionnaires, and interviews of the *PARKS* teams. Key findings with respect to the project outcomes include:

■ The *PARKS* teams successfully integrated the **National Science Education Standards** into their programming. Evidence of student engagement, active participation and use of inquiry was found in many of the programs observed. Further, the *PARKS* project demonstrated that when the NSES are incorporated into the programs, students demonstrate higher levels of perceived science learning. However, the incorporation of the NSES in the *PARKS* programs did not appear to be related to student attitudes, enjoyment of learning, or stewardship.

■ **Collaboration** between teachers and park educators was at the heart of the *PARKS* model, and the collaborative approach to programming was successful in meeting participating teachers' curricular needs. Programs in which students demonstrated higher levels of all outcomes also had stronger park-school partnerships.

■ Overall, the students in the *PARKS* programs showed high levels of **stewardship** of the National Parks and their resources. Students participating in longer programs also demonstrated higher levels of stewardship. Students who had visited the park sites with their class prior to participating in the *PARKS* programs showed higher levels of stewardship for the Parks. In fact, previous visits to the NPS site were positively related to other student outcomes as well, including perceptions of science learning, attitudes toward the National Parks, and the belief that science is in their everyday world.

■ Teachers participating in the project, both as team members and as participants, benefited from their experience with the *PARKS* programs. Two-thirds of the participating teachers surveyed indicated that the *PARKS* program had provided them with ideas that they could use in their own **science teaching**.

■ Thirty-five of the 36 *PARKS* programs have plans for **continuing and/or expanding** over the next two years. More than 85 percent of the teams indicated that they could use their *PARKS* project as a model for integrating National Education Standards for non-science disciplines.

The *PARKS* program evaluation indicated that the project was successful in establishing partnerships that resulted in park-based science education incorporating the National Science Education Standards. In this way, the *PARKS* project played a role in science education reform. Students and teachers across the United States were engaged in science learning incorporating the strengths of both formal and nonformal instructional approaches.

"Wow! Look how beautiful they are!"
—middle school student spotting his first Tule Elk in Point Reyes National Seashore's PARKS *program*

Point Reyes National Seashore

Introduction

What was the PARKS project?

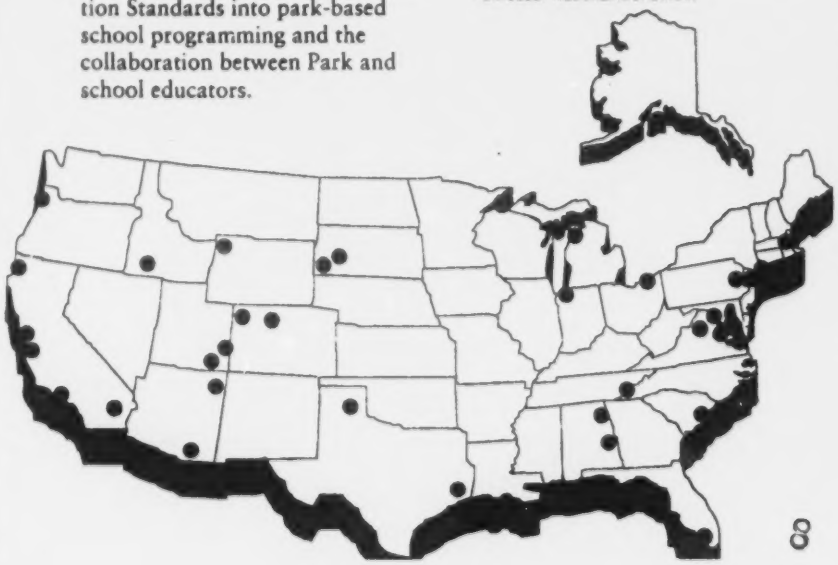
Background

The *Parks As Resources for Knowledge in Science*, or *PARKS*, project was funded by the National Park Foundation through generous support from ExxonMobil Corporation. It supported environmental and science education in 36 National Park Service (NPS) units across the United States. Also included in the national PARKS partnership were the National Science Teachers Association and The Ohio State University Environmental Program Evaluation Working Group. The 36 individual program topics, audiences, and products varied across the sites, reflecting the unique resources and educational program initiatives within each of the National Parks. Two primary concepts united these local-level programs: the incorporation of the National Science Education Standards into park-based school programming and the collaboration between Park and school educators.

At each of the 36 National Parks units, park educators partnered with teachers from local schools to improve park-based school programming. These local teams consisted of at least one National Park Service educator and two teachers from the nearby school or district. The program topics were as varied as the program locations. They ranged from the swamp ecosystem of southern Florida and glacial processes in coastal Alaska, to desert geology in California and the math and science of surveying in eastern Virginia. Each program incorporated the natural and cultural resources of the National Park System into curriculum-based learning opportunities for teachers and students.

Project National Park Units

- Apostle Islands National Lakeshore
- Badlands National Park
- Big Cypress National Preserve
- Big Thicket National Preserve
- Canyon de Chelly National Monument
- Channel Islands National Park
- Cuyahoga Valley National Recreation Area
- Delaware Water Gap National Recreation Area
- Dinosaur National Monument
- Edison National Historic Site
- Ft. Clatsop National Memorial
- Ft. Sumter National Monument and Charles Pickney National Historic Site
- Gateway National Recreation Area – Staten Island Unit/Great Kills Park
- George Washington Birthplace National Monument
- Glen Canyon National Recreation Area
- Golden Gate National Recreation Area
- Great Smoky Mountains National Park
- Hagerman Fossil Beds National Monument
- Indiana Dunes National Lakeshore
- Joshua Tree National Park
- Kenai Fjords National Park
- Lake Meredith National Recreation Area
- Little River Canyon National Preserve
- Lowell National Historic Park
- National Capital Parks East – Kenilworth Aquatic Gardens
- Point Reyes National Seashore
- Redwood National and State Park
- Rocky Mountain National Park
- Santa Monica Mountains National Recreation Area
- Shenandoah National Park
- Sleeping Bear Dunes National Lakeshore
- Southeast Utah Group: Canyonlands & Arches National Parks & Natural Bridges National Monument
- Tumacacori National Historic Park
- Tuskegee Institute National Historic Site
- Wind Cave National Park
- Yellowstone National Park



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"Working with other members of the school system has brought the understanding of the grade school and high school closer."
—team teacher, Apostle Islands National Lakeshore

Most of the National Park sites involved in the project featured a natural resource focus, but several utilized a more cultural or historic connection to science learning. For instance, Channel Islands National Park involved students directly in restoration work in threatened park ecosystems; while several other *PARKS* programs had students collecting data to be used by NPS land managers. Edison National Historic Site in New Jersey framed its programming around the life and inventions of Thomas Alva Edison while guiding students through an exploration of the science of sound and recording.

The project was defined by six program goals:

Goal One: Integrate the National Science Education Standards into National Park Service curriculum-based education programs

Goal Two: Create a model framework for integrating the National Education Standards into other National Park Service programs

Goal Three: Promote the National Parks as learning laboratories and provide opportunities for students and teachers to use National Park Service resources to achieve the National Science Education Standards

Goal Four: Enhance the quality of science education for students nationwide

Goal Five: Increase knowledge of, and stewardship for, National Park Service resources, the National Park System, and associated resources

Goal Six: Establish Parks As Classrooms® models that can be replicated at other National Parks, while fostering the incorporation of National Science Education Standards into existing and future National Park Service education programs

The PARKS National Evaluation

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Focusing on...

Program Progress:

- **Project Description Questionnaires** sent to the local *PARKS* teams at the beginning of the grant period
- **Semi-annual Reports** from the local *PARKS* teams
  The local *PARKS* teams completed two semi-annual reports in 1999 and one at the end of the project (December 2000).

NSES and Program content:

- **Site Visits by the Evaluation Team**
  Thirty-one of the *PARKS* sites were visited in the last year of the project.
  - **Program Observations** of *PARKS* related programming
    Twenty-five programs were observed during site visits to the National Park sites. These took place in the Parks, at schools, at partner sites, and included teacher workshops as well as student activities.
  - **Interviews** of the local *PARKS* teams conducted during site visits
    Thirty-one *PARKS* teams were interviewed during site visits to the National Park sites.
- **Review of the Materials/Curriculum** submitted by the *PARKS* teams at the end of the grant period
  Sixteen of the *PARKS* teams submitted curriculum or other materials associated with the project. These were reviewed primarily for evidence of the National Science Education Standards.

Program Impact:

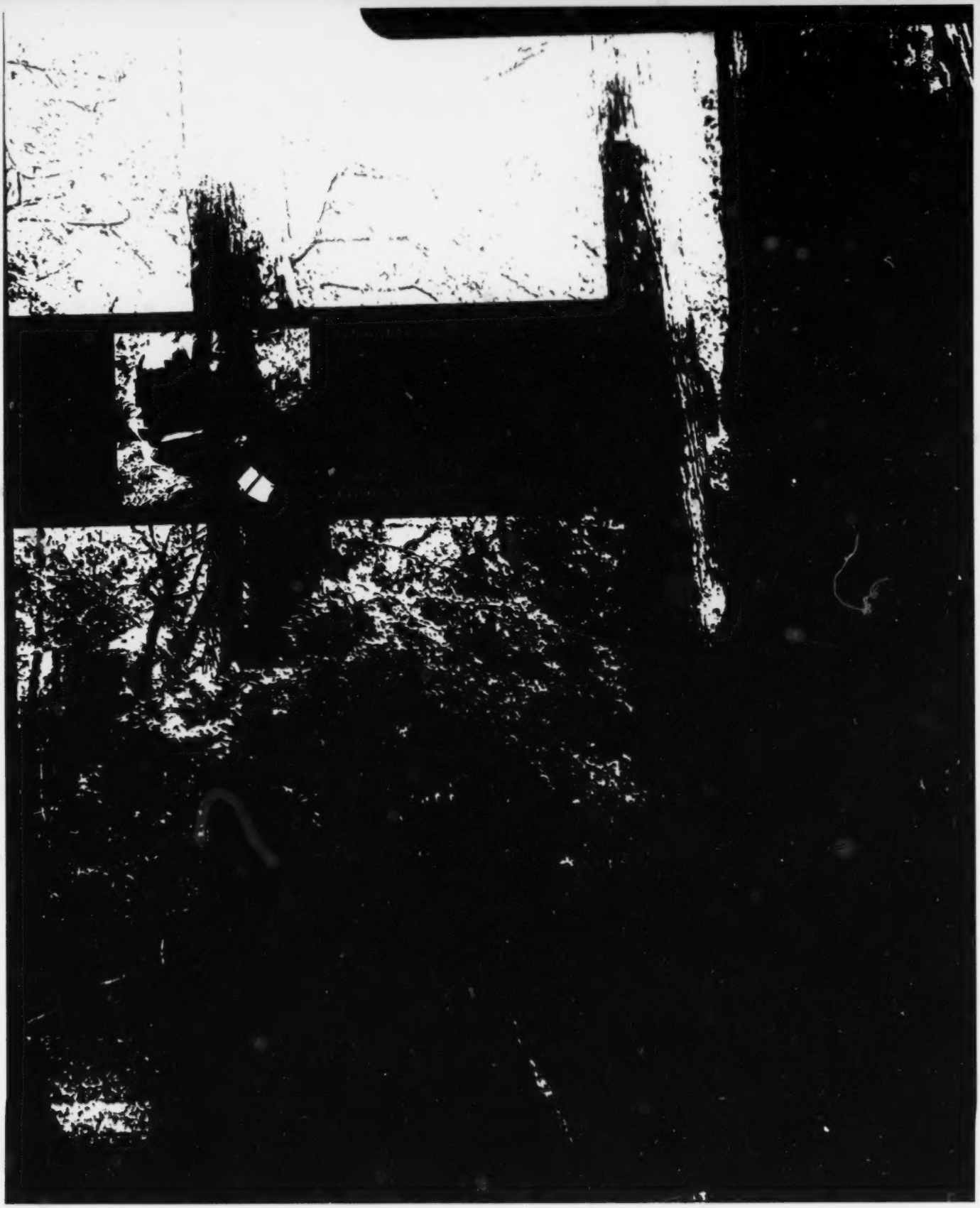
- **Teacher Feedback Questionnaires** sent to teachers whose classes had participated in *PARKS* programs at selected sites
- **Student Feedback Questionnaires** sent to program participants in selected *PARKS* programs
  Questionnaires were sent to program participants at a subset of eight *PARKS* sites; 38 teachers and more than 900 students completed the questionnaires.

Team Collaboration:

- **Team Questionnaires** sent to each member of the local *PARKS* teams
  Seventy-three team members (teachers and park educators) completed the questionnaires.
- **Park and School Administrator Questionnaires** sent to administrators at each of the participating National Park units and the team teachers' schools or districts
  Forty-eight administrators (park and school superintendents, NPS division chiefs, and school principles) completed the questionnaires.

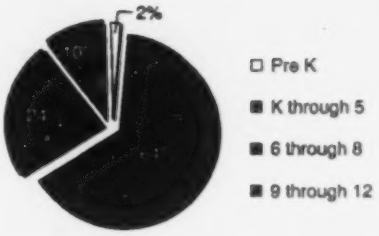
"The opportunity this grant has afforded me to establish relations with other parks has been extremely beneficial. I have both helped and been helped by others on a wide range of efforts, not limited to this grant project."
—Park educator, Yellowstone National Park PARKS *team*

These data collection instruments were designed based on the 91 stakeholder questions submitted by the national stakeholder panel. The Ohio State University evaluation team worked closely with the National Park Foundation to finalize the format of each instrument and implement the data collection. One of the key characteristics of the *PARKS* program evaluation was its attention to the evolving needs of the program and program partners over the course of the grant period. This adaptive and reactive approach resulted in some alterations to the original data collection plan, which enabled the evaluation to gather data that were appropriate, feasible, and useful while maintaining attention to the accuracy of the findings. Information on the development and testing of these instruments can be obtained from the Ohio State University Environmental Program Evaluation Working Group. A full technical report on the evaluation findings is available from the National Park Foundation.



Program Descriptives

Who was involved in the *PARKS* project?



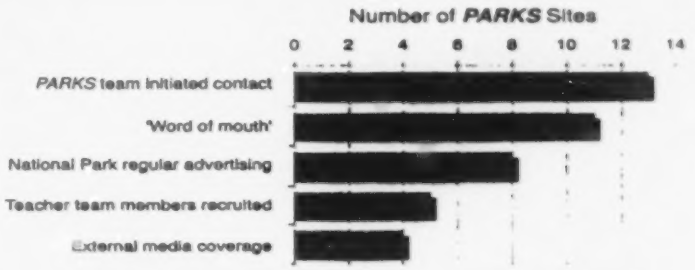
PARKS teams documented 89,619 student participants in their programs.

The 36 *PARKS* teams put together their programs and then began offering their science-based education to the public during the second and third years of the grant period. Of the more than 91,000 participants in *PARKS*-related programming in 1999 and 2000, 1,777 were teachers or other education professionals participating in workshops. Elementary students, with 57,152 reported participants, were the most widely served audience in the *PARKS* programs.

More than half of the participating teachers questioned indicated that at least some of their students were special needs students, including gifted, learning disabled, and physically challenged children. The vast majority of the classes participating in the *PARKS* programs were from public schools. These schools ranged from less than a mile to hundreds of miles from the NPS sites. One high school class in the Big Cypress National Preserve *PARKS* program studied the water quality at its site during the school science period several times throughout the school year. Being only 15 minutes from the park site enabled the program to incorporate these repeated visits. Most schools, however, were able to visit their *PARKS* site only once, and those visits were supplemented by other activities in the classroom, led by both teachers and visiting NPS educators.

New Audiences Reached

The *PARKS* teams made a concerted effort to target new audiences – those who had not previously been served by any educational programming at the NPS site. Eighty-nine percent of the *PARKS* programs served audiences that were new to National Park programs during the final year of the project; up from 63 percent reported at the end of the first year.



Teams reported a variety of ways in which new audiences were introduced to *PARKS* programming.

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Program Descriptives

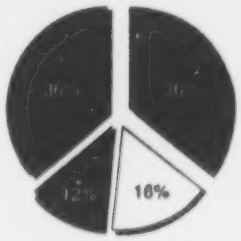
What *PARKS* programs looked like...

PARKS programs took many forms. More than 500 different curriculum materials were produced for use in programming as well as distribution to participating teachers and students. These materials included 128 lesson plans/thematic units, 93 evaluation instruments, 71 curriculum guides, and 18 Web sites. The overwhelming majority of PARKS programs were in-school or in-Park experiences for K-12 students that lasted up to half a day. Programs were led primarily by NPS personnel, sometimes with the help of the participating teachers or NPS volunteers.

More than 70 percent of the programs took place predominately outdoors. Half of those taking place at the school brought the students out of the classroom to explore the environment near their schoolyards. In Utah, for example, students learned about plant reproduction by examining the flowers near their school, while in Texas students recorded daily weather outside their classroom to learn about climate. While students indicated that they had a variety of experiences in the *PARKS* programs, 84 percent reported that they participated in group-oriented learning activities.

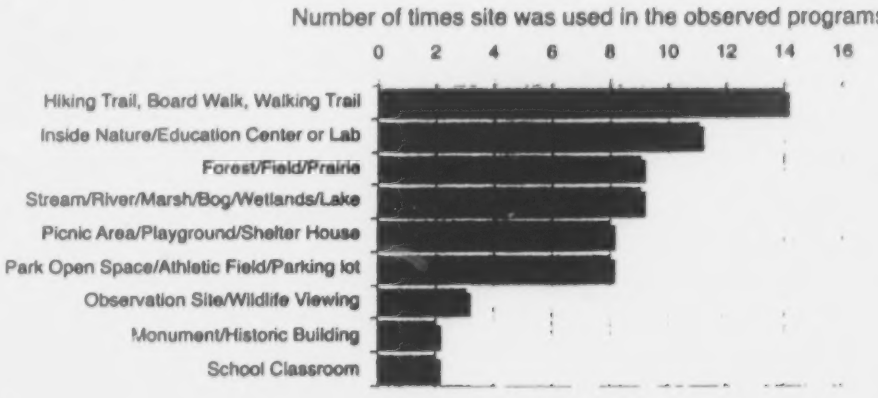
"The whole time I was thinking about how I could use this in my class."

—teacher at a PARKS *workshop at Ft. Clatsop National Memorial*



PARKS programs ranged from the length of a school class period to overnight experiences.

Shenandoah National Park



Even with the National Parks, a variety of sites were used in the *PARKS* programs.

Inputs

What went into the *PARKS* project?

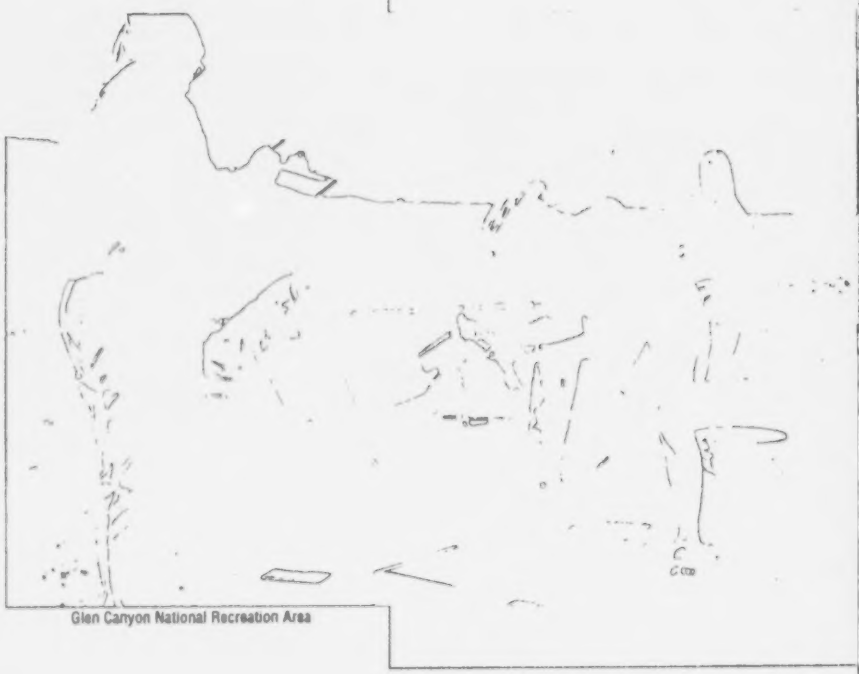
Local PARKS teams engaged in a four-step process – partnering, collaborating, integrating, and programming. The PARKS project approach was based on the belief that through collaborative efforts, the National Science Education Standards could be integrated into Park-based programming to improve science learning and stewardship for the National Park Service.

Ft. Clatsop National Memorial

Collaboration

Collaboration is a mutually beneficial and well-defined relationship entered into by two or more organizations to achieve common goals.

Many of the *PARKS* team members had a relationship with one another prior to working on this project; however, the relationships typically were not formalized. The teams generally were formed for the purpose of working on the *PARKS* project and coalesced after the grant was awarded. Approximately half of the teams interviewed used an advisory board to help guide their local programs.

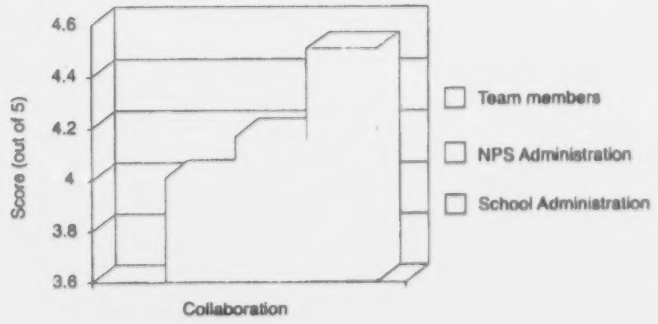


Glen Canyon National Recreation Area

Six Elements of Effective Collaboration Adapted from (Mattessich and Monsey, 1992)

Environment	*Political and social climate, administrative support & experience in collaboration*
Membership Characteristics	*Team member buy-in, mutual respect, and appropriate representation*
Process Structure	*Clear roles, flexibility, & individual stake in successful outcomes*
Communication	*Open, frequent, & established links for communicating*
Purpose	*Shared vision & unique purpose*
Resources	*Sufficient funds and personnel devoted to project*

At the end of the project, the team members, as well as the park and school administrators of the partnering organizations, rated the *PARKS* teams' collaborations. While all three groups described the collaborations as relatively strong, school administrators perceived that the collaborations were significantly stronger than did the actual team members.



The strength of the *PARKS* collaborations, as percieved by NPS administrators, partner school administrators, and the team members themselves.

George Washington Birthplace National Monument

Challenges

When asked what they would change about the collaboration process, many of the *PARKS* teams indicated that they would make formal agreements between the partner organizations as well as structure more time for planning and meeting. During the first year, the greatest obstacle to both planning and implementing the *PARKS* programs was that of time. Twenty-one teams indicated that time, in some form or another, was the most significant challenge in their programming.

Time Troubles:

- Finding the time to meet with teacher team members
- Finding time to accommodate *PARKS* programs and participants while maintaining the "already-established" NPS programs
- Scheduling issues, such as the late arrival of participants to the Park due to "travel or transportation issues" and "time limits for the buses, resulting in one hour or less in the park" for students

"I try to incorporate technology into every area of my curriculum. This [Web]site will allow me to meet science and technology goals."

— teacher, Cuyahoga National Recreation Area PARKS *program*

As the project progressed into its second year of programming, the most significant challenge surrounding the work of the team dealt with loss of team members. The teams found themselves replacing "lost" team members as both NPS and school partners incurred staffing changes that pulled invested members from the original partnership.

Incorporating the National Science Education Standards

The National Science Education Standards (NSES) were developed to serve as guidelines for better science teaching and learning in our nation's schools. The NSES address seven areas: content, teaching, assessment, professional development, program, and system standards. Each of these areas was integrated by the *PARKS* project into park-based education programs.

Content

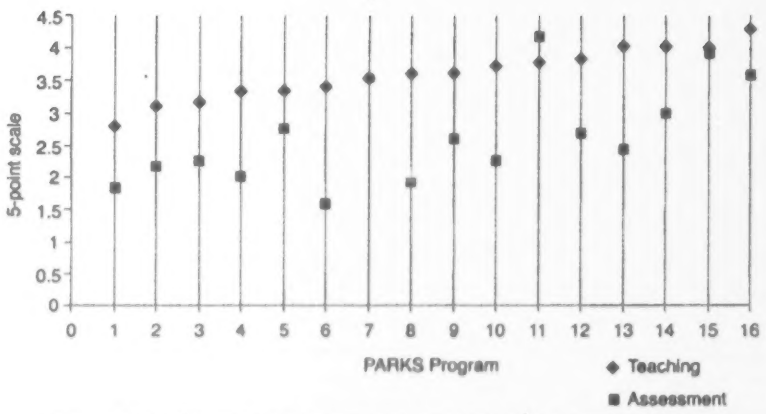
Many state departments of education have outlined content standards specific to their school systems. Although based on the NSES content standards, the state standards supercede the National Standards in practice. Therefore, non-content NSES were the focus of the *PARKS* project goals and evaluation.

Teaching

The NSES teaching standards specifically call for science learning to extend beyond the classroom and for teachers to access and utilize available local resources in the science program. This standard was addressed merely by the existence of the *PARKS* programs themselves. However, many of the *PARKS* programs incorporated specific elements of the teaching standards. Group learning activities, inquiry-based approaches, and participatory discussions were observed in many of the programs.

Assessment

The assessment standards were not as apparent as the teaching standards in the reviewed *PARKS* program materials (16 of the 36 *PARKS* programs submitted materials for review). In all but one of the 16 programs, the teaching standards were more or equally evident as the assessment standards in the written materials. *PARKS* materials, while often providing means by which assessments could be made, did not always guide the user of the materials in constructing interactive assessments of learning.



The extent of NSES teaching and assessment standards in the educational materials of 16 of the 36 PARKS programs.

Professional Development

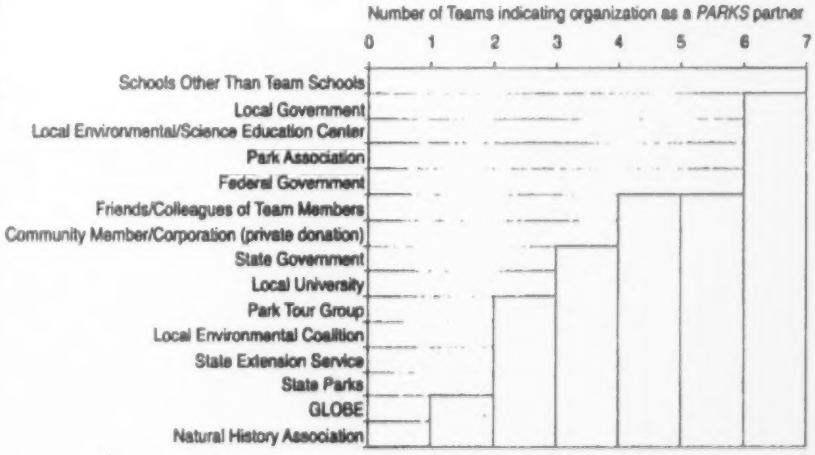
PARKS team members indicated that their participation with the grant work had fulfilled professional development needs for them. Additionally, 58 percent of the *PARKS* teams reported that they hosted teacher workshops either as the main focus of their project or in preparation for the participating teachers to bring their students to the Park site. These workshops introduced teachers to the NPS resources and also provided them with new ideas and skills to enhance their students' learning. Teachers whose students were the primary participants in the *PARKS* programs also benefited professionally. Sixty-six percent of the teachers in the eight-park subset indicated that they had observed a completely new way to teach science.

Program

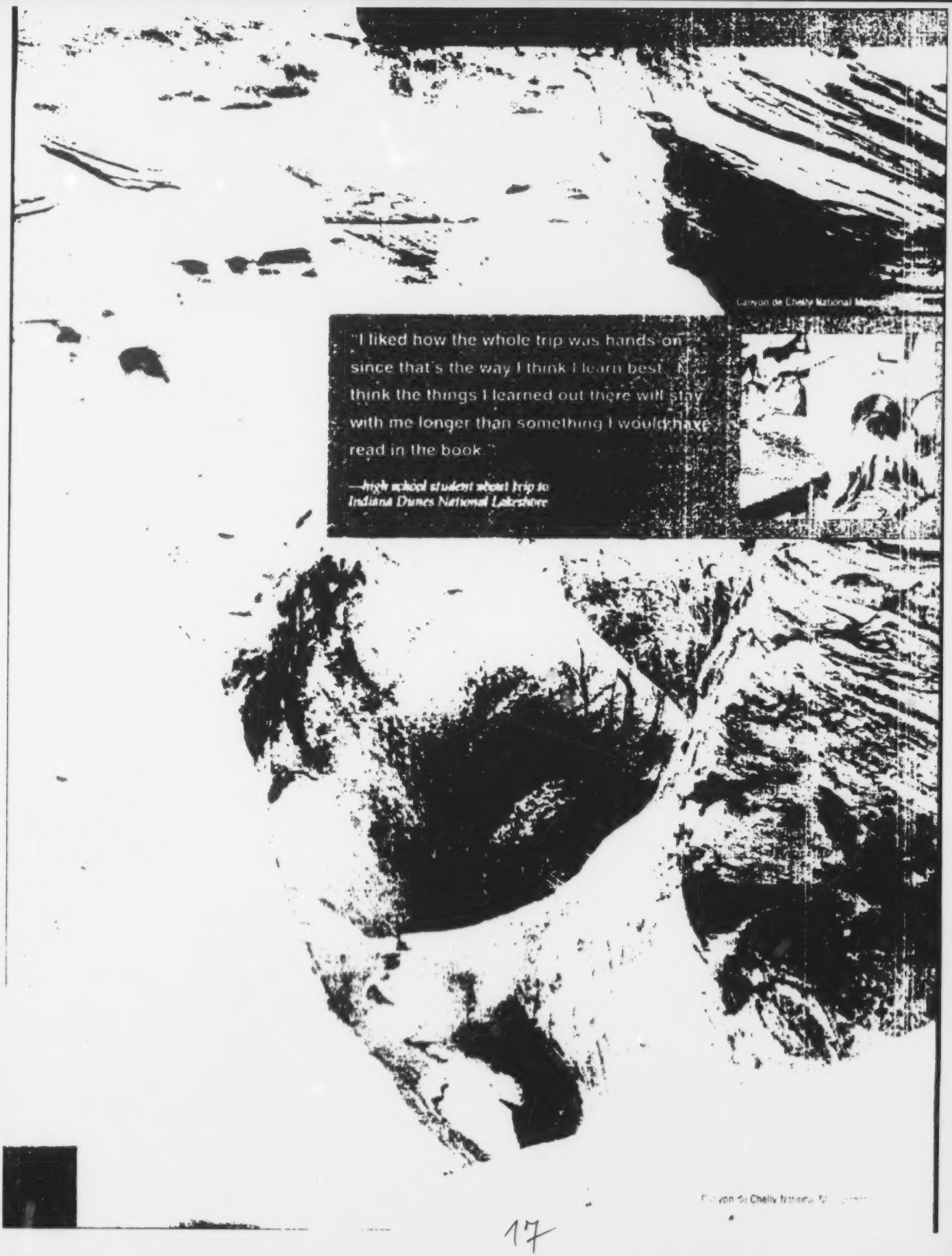
Program and system areas are also described by the National Science Education Standards. Most *PARKS* teams did not directly address these areas; however some sites like Joshua Tree and Shenandoah National Parks were expanding existing programs to include multiple grade levels. By addressing the curricular needs of local schools for each grade level, these *PARKS* programs helped schools meet the program standards.

System

Finally, system standards – those outlining the need for consistent science education policy throughout communities – were addressed by the local *PARKS* stakeholder groups. Input from agencies and organizations outside the partner schools and Parks was an important part of the *PARKS* programming for many teams. Participation from partner organizations enabled a broad representation of organizations to participate in guiding science education in their communities. These partnerships and the input on the local communities' science education spanned a diverse collection of agencies and organizations.



PARKS teams involved a variety of agencies in their local partnerships.



"I liked how the whole trip was hands-on since that's the way I think I learn best. I think the things I learned out there will stay with me longer than something I would have read in the book."

—high school student about trip to Indiana Dunes National Lakeshore

Outcomes

How were the people involved affected by the project?

The *PARKS* programs had an impact to some extent on all those who were involved with the project. In addition to the outcomes relating to program participants - students in grades K-12 and their teachers – project outcomes with respect to the team members, the National Park sites and the partner schools, as well as the NPS sites' educational programming were evaluated. Some key findings...

Participant Students

All of the outcomes measured: attitude toward science, attitude toward the National Park, enjoyment of learning at the Park, perception of science learning and skills gained, belief that science is in the everyday world, and learning motivation/intent to use the Park were all positively related to previous visits to the Park. Students who reported having been to the National Park site prior to the *PARKS* program consistently reported stronger positive levels of the outcomes. Nearly 50 percent of the students had visited the Park previously, and, of those, all indicated that they had come with a school class.

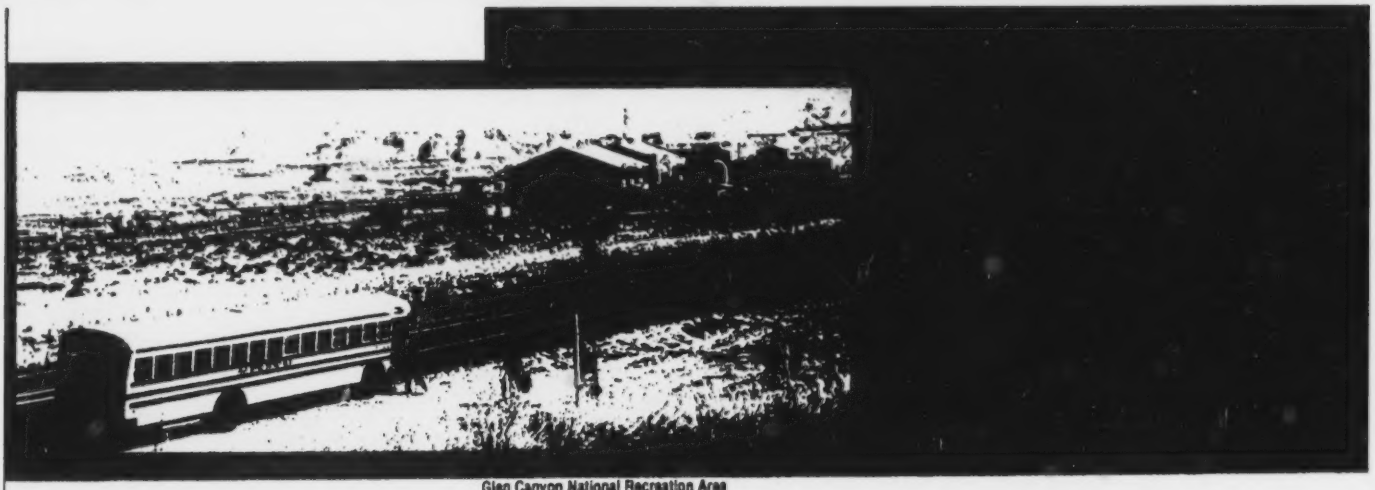
Another interesting finding emerged from the program locations. Programs generally took place either in the National Park, at the school, or at both locations. Students whose programs took place only in the school setting had significantly less positive attitudes toward the National Park. Multiple visits to the Parks could therefore lead to more positive attitudes about the National Park, as well as a more generalized understanding of science in the everyday world, and stewardship of park resources.

Science learning

Nearly 90 percent of the teachers used an activity provided by the National Park in their classroom prior to their visit. In the observed programs, students used ▶

"Cool! Look at the baby seeds!"

—student observing plant seeds under a microscope in Canyon de Chelly National Monument's PARKS *program*



Glen Canyon National Recreation Area

"Before, our teen audience hid in the shadows, afraid to speak or ask a question ...Now, midway through the tour, they are asking their own questions freely."

—Park educator, Edison National Historic Site PARKS team

science skills that were familiar to them twice as often as they employed new science-related skills in the programs. In this way, the *PARKS* programs tended to build on classroom learning while providing new contexts for the students' science knowledge.

Students strongly endorsed the idea that "Park programs are a good place to learn about science," while they disagreed with the statement, "I did not learn very much at the Park program." Students engaging in the scientific method as part of their *PARKS* program appeared to be learning the *basics* of science better. However, only in those programs where they worked together to "help each other with a science-related task" did they appear to be learning broader science-related concepts.

The program observations showed that students were learning science-related concepts. Fifty percent of the programs observed by the evaluation team contained evidence that students both learned science-related concepts and seemed to make a connection with the Park resource.

The presence of the NSES teaching standards as measured by the teacher and student feedback questionnaires from the eight-park subset was positively related to the students' perception of science learning and skills.

The relationship between the NSES teaching standards and attitudinal student outcomes was less clear.

Science in the everyday world

PARKS teams indicated that one of the benefits of learning science in their programs, in addition to the hands-on and engaging format, was that students were becoming aware that science is more than just a school subject. In fact, students demonstrated an understanding that science exists outside the classroom in many ways. For example, when introduced to radio-telemetry and geographic positioning equipment in their search for panther habitat, students in Big Cypress National Preserve immediately made connections to the fish-detection equipment on their parents' boats. In Shenandoah National Park, the students learned about the concept of adaptations and easily made comparisons between a turtle's shell and the football helmets worn by their favorite team. Students who saw science in their everyday world also tended to have a greater appreciation for the National Park as a place for learning and also expressed greater enjoyment of learning science in the Parks.

Enjoyment of parks and learning

While the extent of the teaching standards observed by participating teachers in the *PARKS* programs was related to the students' learning of science, it was not significantly related to students' enjoyment of their learning experience. However, students' enjoyment of the Parks was relatively high. Comments from the students during the programs illuminated the impact that learning in the National Park setting can have: "I love doing stuff like this - it's very, very fun" (student in Gateway National Recreation Area *PARKS* program).

Stewardship and Opportunity to connect to the resource

The students' stewardship of the National Parks and their resources

Youth stewardship of natural and cultural resources in nonformal educational settings is comprised of four primary factors: long-term commitment to the resources and/or the places in which they are found; a desire to protect those resources and places for the future; socially-endorsed, situational environmental behaviors; and internal locus of control with respect to actions toward the environment.

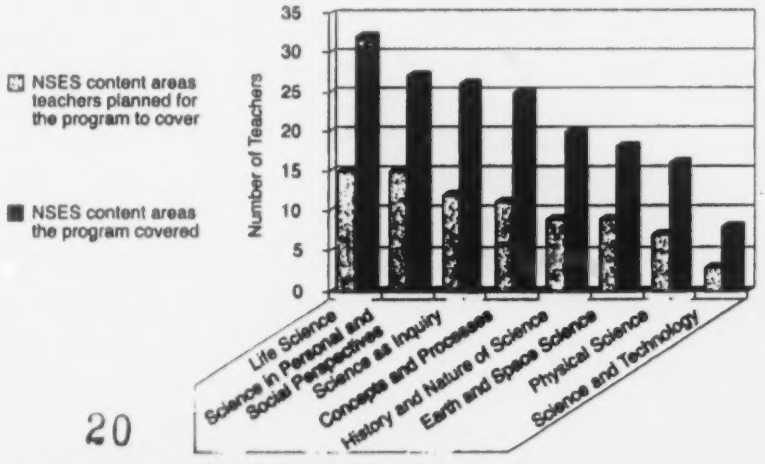
was of particular interest in the *PARKS* project. Youth stewardship of natural and cultural resources in nonformal educational settings is comprised of four primary factors: long-term commitment to the resources and/or the places in which they are found; a desire to protect those resources and places for the future; socially-endorsed, situational environmental behaviors; and internal locus of control with respect to actions toward the environment. These factors were derived empirically from the student sample and are present to varying degrees in all *PARKS* students. Students with a stronger affinity for each of these factors were considered to express higher levels of stewardship for the Parks and their resources. Stewardship was positively correlated with the length of the *PARKS* programs, pointing to the possibility that multiple-day programs provide more opportunity for developing stewardship in the participants.

Students' "opportunities to connect" to the Park resources ratings varied depending on the location of their *PARKS* program. Students participating in programs that had components at both the school and the National Park site had significantly higher opportunities to connect with the resource. The relationship between stewardship and the opportunities to connect with the Park resources was not entirely clear, and would benefit from future study.

Participating Teachers and Schools

The teachers whose classes participated in *PARKS* programming indicated that they, too, were affected by the experience. Ninety-two percent of the teachers indicated that they "really enjoyed themselves" at the program. Nearly 75 percent of them found that the *PARKS* program visit allowed them to spend time getting to know their students better. Two-thirds of the responding teachers also indicated that the *PARKS* program had provided them with ideas on methods and approaches that they could use in their own science teaching.

Participating teachers indicated that the *PARKS* programs were meeting and even exceeding their needs in terms of science content. Most teachers indicated that, in addition to the content that they had planned for the program to cover, the *PARKS* programs covered areas beyond what was expected. On the whole, teachers were pleased with the program content as well as the experience for both themselves and their students.



The 38 teachers expressed that the PARKS programs covered more science content than they had anticipated.

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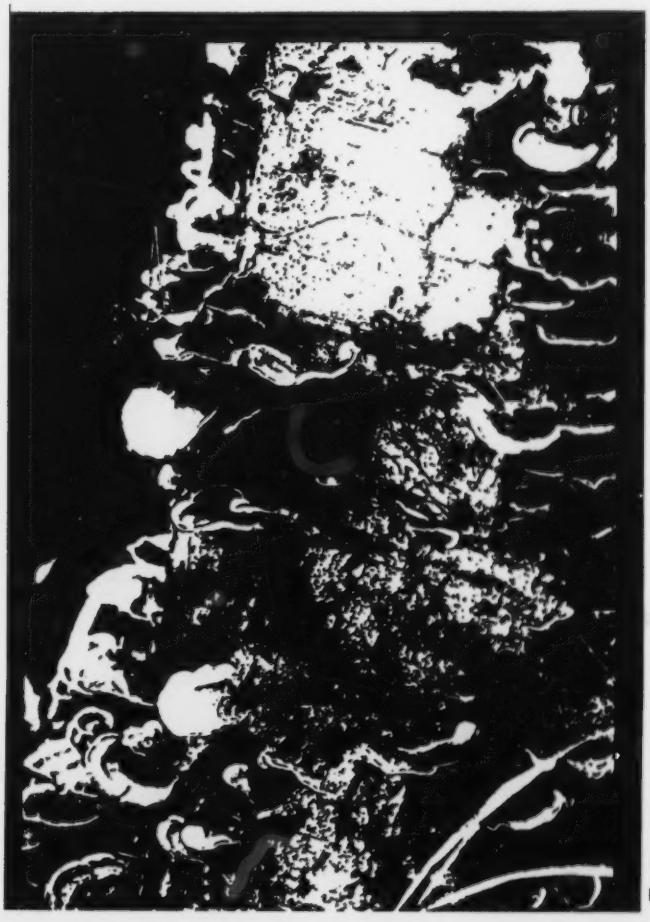
Golden Gate National Recreation Area

Teams

The team members, both school and Park, described a number of benefits from their participation in the *PARKS* project. Most teams indicated that they benefited from the professional development opportunities afforded them through the partnership. These benefits included gaining technical and resource-based knowledge to use in programming, networking opportunities, learning "each other's" educational vocabulary, and having a forum for sharing ideas. Park educators mentioned that they had a better understanding of schools' and teachers' needs and preferences with respect to programming. Parks reported that they "have acquired a new respect for what teachers do," and that "working with education professionals has given...a fuller understanding of what curriculum-based programs entail and how to make the most of those programs in order for the students and teacher to receive maximum benefit."

Seventy-five percent of the National Park administrators at *PARKS* sites indicated that their education staff had gained enthusiasm for working with schools and teachers because of this project. Similarly, teachers expressed that they learned about the National Park Service and its resources and how they could fit into science education. For some, it was an opportunity for their schools to understand and appreciate the National Park Service's "dedication" to education. Team teachers benefited in more direct ways as well: 67 percent of the school administrators said that the teachers involved in the *PARKS* project had gained more enthusiasm for their teaching as a result of their participation.

Several teams reported that a major benefit was becoming "familiar with the National Science Education Standards and how they apply," particularly for the Park educators. Of the 31 Park educators interviewed, about 80 percent indicated that their knowledge of NSES at the beginning of the project was minimal or nonexistent, and during the first year of the project, one of the challenges described by the teams was that of learning and becoming familiar with the standards. By the second year of the project however, all but two of the Park educators who had not been familiar with the standards felt that their knowledge had improved. Team teachers were generally already more familiar with the NSES; however, their work with the projects benefited their schools with new resources for meeting the standards. In the interviews con-



Big Thicket National Preserve

Team benefits included gaining technical and resource-based knowledge to use in programming, networking opportunities, learning "each other's" educational vocabulary, and having a forum for sharing ideas.

ducted during the final year of the project, team members cited that learning process as one of the greatest benefits of their collaboration experience.

NPS Programming

The *PARKS* project created a framework for linking the NPS to formal education in the schools and, by establishing Park-school partnerships, instilled some level of accountability for maintaining those connections across the local communities. The strength of these collaborations varied across the *PARKS* programs; in the eight-park subset, programs with lower levels of stewardship and learning in their participants also had weaker collaborations.

The National Science Education Standards

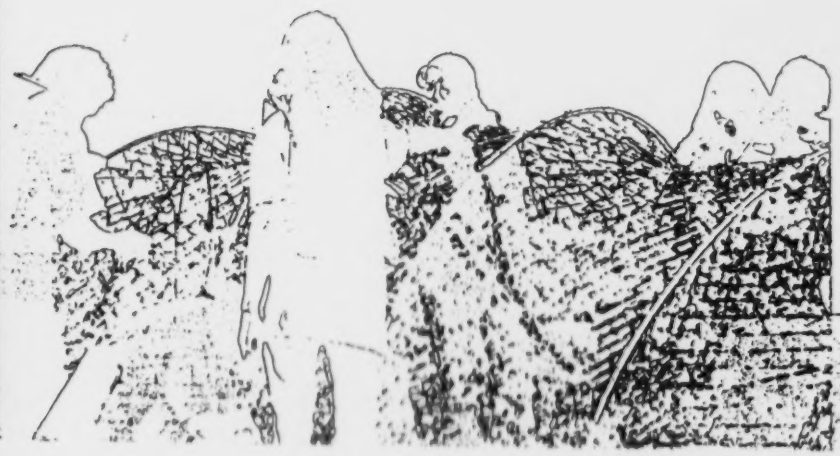
The *PARKS* programs were filled with activities, processes, and concepts that demonstrated the presence of the NSES. In practice, the *PARKS* programs had most definitely integrated the NSES teaching standards, and they were reflected to some degree programs' educational materials. All of the National Park administrators questioned indicated that members of their education staff either had already or were likely to "use more active learning techniques with students" as a result of the *PARKS* programming. This evaluation did not compare *PARKS* programming with National Park education programs prior to this project, and it is likely that much of the NPS programming contained elements of the NSES before the *PARKS* project began. However, 85 percent of the National Park administrators indicated that their educators were using more "hands-on" learning techniques as a result of the *PARKS* project. More than half of the teachers in the eight-park subset said that they were more motivated to try new teaching methods as a result of participating in the program.

Plans for the future

Many of the *PARKS* teams indicated that this project enabled them to create a model to use with other NPS educational programming at their sites. The ideas, strategies, and knowledge gained from the *PARKS* project were perceived as resources for creating new programs and enhancing existing ones. Thirty-five of the teams had plans for continuing their *PARKS* programs and utilizing their products over the next two years.

In addition, two *PARKS* programs were formally incorporated into the local school or district's K-12 curriculum. Many other programs were relied upon as part of the curriculum of the participating teachers.

Strategy for program continuance	Percentage of parks
Expansion to new audiences	46%
Program is now part of permanent NPS curriculum	32%
Park site administration is formalizing support for the program	29%
PARKS program will be/already being used as leverage for further funding	29%



"I felt like a scientist today...I've never done this before, and we had all this equipment that I never used before."

—student participating in Santa Monica Mountains National Recreation Areas' PARKS program

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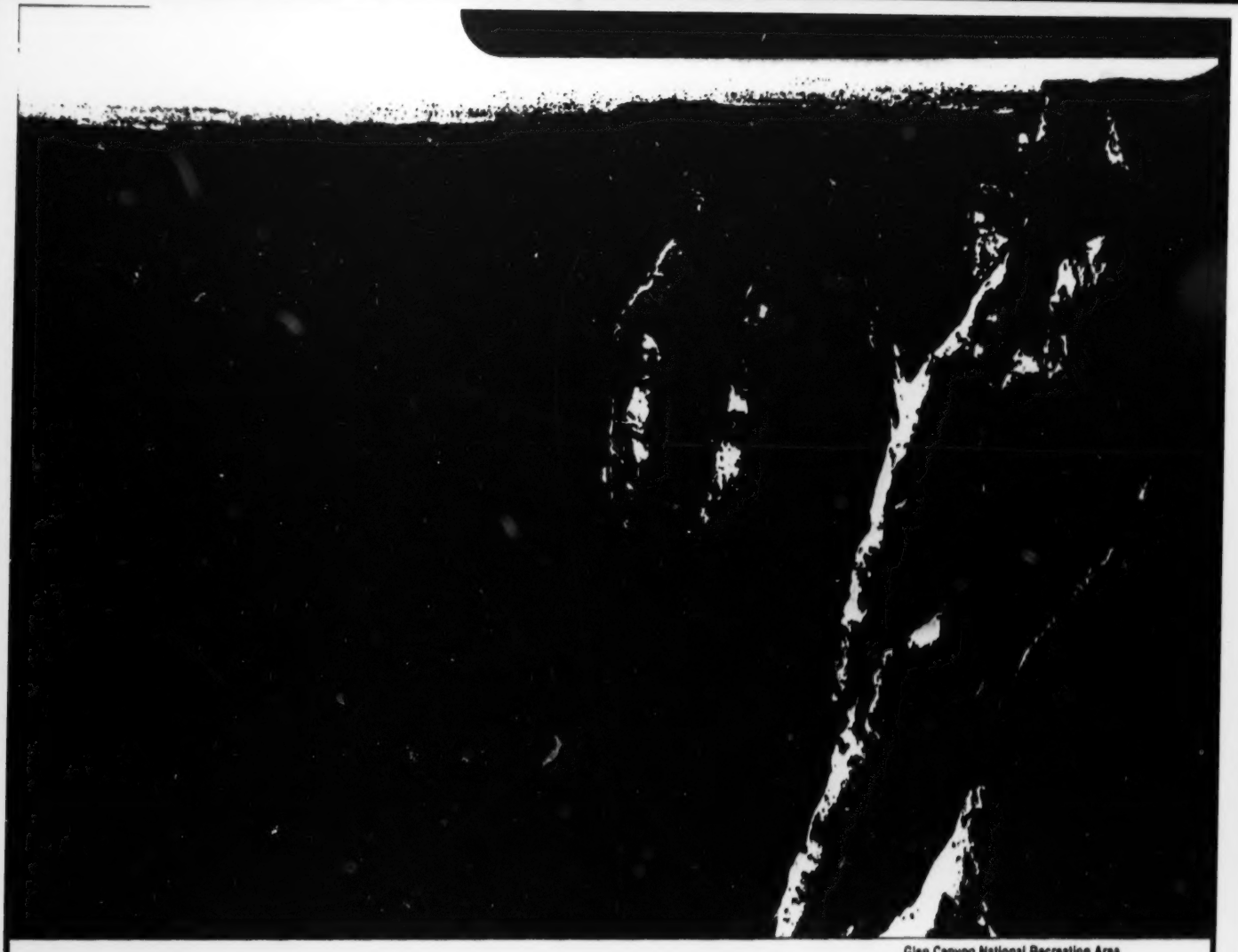
Glen Canyon National Recreation Area



Glen Canyon National Recreation Area

Conclusions & Recommendations

Final Thoughts

Collaboration

Collaboration was a key part of the *PARKS* project model in which education standards were infused into Park-based programming to enhance student learning. Sustaining programs and partnerships can be much easier when all levels of the partnering agencies are involved, invested, and supportive. Because the elements of effective collaboration can be complex, collaboration must infuse multiple levels and initiatives within the partner organizations, particularly in longer-term partnerships. In the *PARKS* project, successful collaborations were generally those in which there was administrative support expressed to the teams. In addition, Parks with a history of partnering

with schools on educational programs had the most success in terms of teams whose members expressed a willingness to work together in the future. Some teams needed to "sell their program" to the administrators involved and devoted unanticipated time to cultivating their stakeholder relationships. Integration of training and support with respect to the collaborative process could benefit future collaborative endeavors in which the partners are inexperienced with collaboration.

"The grant has shifted our perspective...we now start any new program development or revision by asking 'How can we make this more useful to teachers and students?'"

—Park educator, Dinosaur National Monument

Dinosaur National Monument

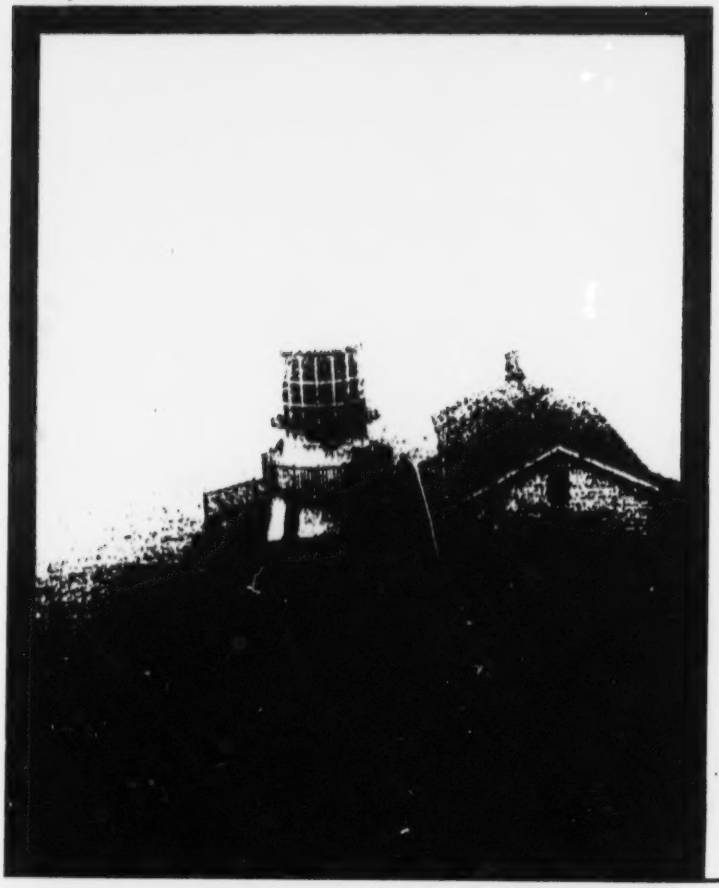
National Science Education Standards

The presence of the National Science Education Standards in NPS programming impacted science learning but not attitudinal outcomes such as stewardship or students' general attitudes toward science. The *PARKS* program endeavored to improve both science learning and Park stewardship – and it did. Half of the observed programs showed clear evidence of both learning science concepts and making affective connections with the Park resources. While in need of further study, the findings on student outcomes support the plausibility of a dual-goal model (targeting attitudinal and knowledge-oriented outcomes) for Park-based science education. This type of programming necessitates the incorporation of program elements that target each type of desired outcome. It is important for Park educators to be attentive to appropriate, specific activities and teaching strategies for each desired outcome in their participants, whether it is stewardship, science learning, or another.

"Before the program, the students visiting the park simply "browsed" through the exhibits... After beginning the program...they became actively engaged in writing down information that would be useful in developing their recycling projects."

—Park educator, Tuskegee National Historic Site PARKS *team*

Point Reyes National Seashore



Stewardship

The fact that the relationship between the measure of opportunities to connect (which was based on contact with the resource) and student stewardship was weak indicates that students may not need to be in or at a Park's resource to engender feelings of stewardship for it. Stewardship was related to the length of the *PARKS* program however; indicating that the amount of time spent learning about and engaging with a resource might play a role in students' outcomes. Students who had visited the National Park site prior to their *PARKS* program had higher levels of stewardship and science learning, as well as an increased ability to generalize those feelings to their everyday world. The *PARKS* project, by getting kids to the Parks, provides that first or second visit that begins the process of lifelong learning and stewardship for the National Parks and their resources. With stewardship related to length of program and to previous visits to the Park sites, some strategies for future programming could be

Big Thicket National Preserve

"Media attention about the grant project caught the attention of neighborhood leaders and other schools. As a result of the attention, the park has established similar partnerships with local schools to adopt streams, using the adoption process as a springboard for science education."

— Park educator, Kenilworth Aquatic Gardens *PARKS* team

Transferability

outlined. Many Parks expressed frustration with the short amount of time that students were able to spend on site because of transportation issues. Parks in more isolated areas may want to consider alternative approaches to program delivery including residential programs, mobile outreach units, or NPS-sponsored student transportation when public school buses cannot accommodate travel needs. More research on these concepts and their relationships could provide detailed direction as to the best modes and durations of programming for curriculum-based Park programming.

The *PARKS* model – integrating education standards through collaborative partnerships between formal and nonformal educators – was tested by 36 unique NPS units. All types of local programs appeared to have similar potential for successful *PARKS* programs – no discernable trends were found in matching the programs' environments to their overall outcomes. However, on a local level, more than 85 percent of the teams indicated that they could use their *PARKS* project as a model for integrating other National Education Standards, such as history or language. Several teams already had begun to do just that.

The diversity of Parks, people, teams, collaborations, and programs is a strong indicator that the *PARKS* program could be implemented with similar success at other NPS sites. However, more research is needed into the factors that affect learner outcomes in Park-based programming across diverse Park settings. The diversity within the *PARKS* project strained the model as well; some teams felt isolated in their programming efforts and many expressed a desire for formalized program support among teams with similar NPS settings. Until more is known about the recipes for success in these types of programming efforts, grouping similar Parks for program support could maximize success for the local programs in future projects.

Joshua Tree National Park

Kenai Fjords National Park

"The project has allowed me an opportunity to be part of designing and teaching a field based class. This has provided a lot of opportunities for insight as well as student learning."

—team teacher, Apostle Islands National Lakeshore *PARKS* team